

PRELIMINARY DATA SUMMARY

January 1990

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Measurements and Analysis work units at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height of 7.6 m above the National Geodetic Vertical Datum (NGVD). In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Michael W. Leffler at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

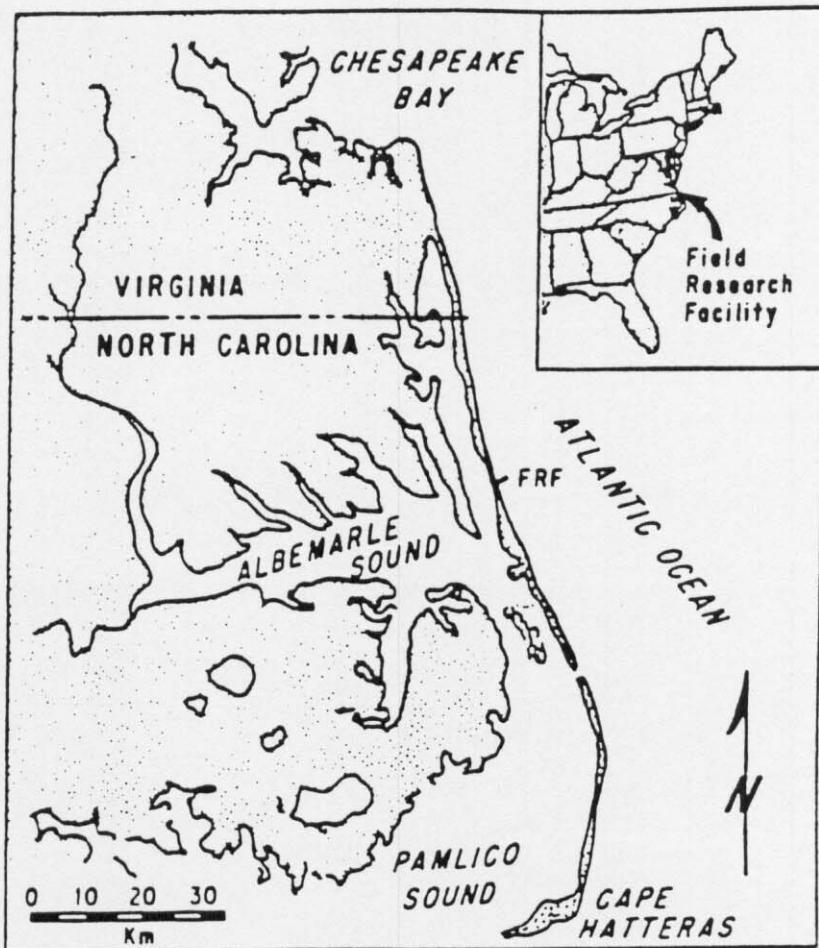


Figure 1. FRF Location Map

Table 1: Instrument Status/Data Availability

JAN 1990

Gage ID	Description/Remarks	Depth at Sensor		Day of the month																																						
				1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1								
616	Barometric Pressure		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*			
			Analog Record	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
604	Precipitation		Gage Status	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
			Data Collected	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
624	Air Temperature		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
932	Anemometer at Seaward end of pier Elevation 19 m (NGVD)		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*
			Analog Record	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
645	Baylor staff at station 7+80 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
625	Baylor staff at station 18+60 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
630	Waverider buoy 6.0 km offshore	Approx. 23 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
519	Current meter 320 m north of FRF pier (0.9 km offshore)	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
			Daily observation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Supplemental Observations (daily oceanographic and meteorological observations)				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		

Gage Status	Daily Observation	Analog Record	Data Collected
Operational = *	Complete = *	Complete = *	All = *
Partial = /	Partial = /	Partial = /	Partial = /
Non-Operational = -	None = -	None = -	None = -

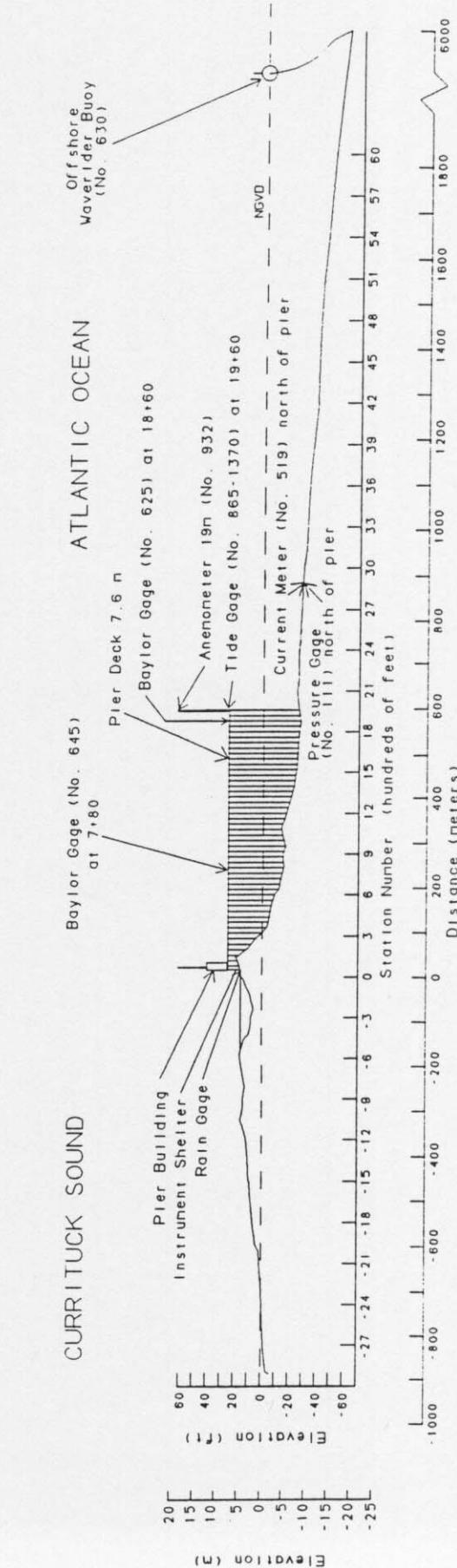
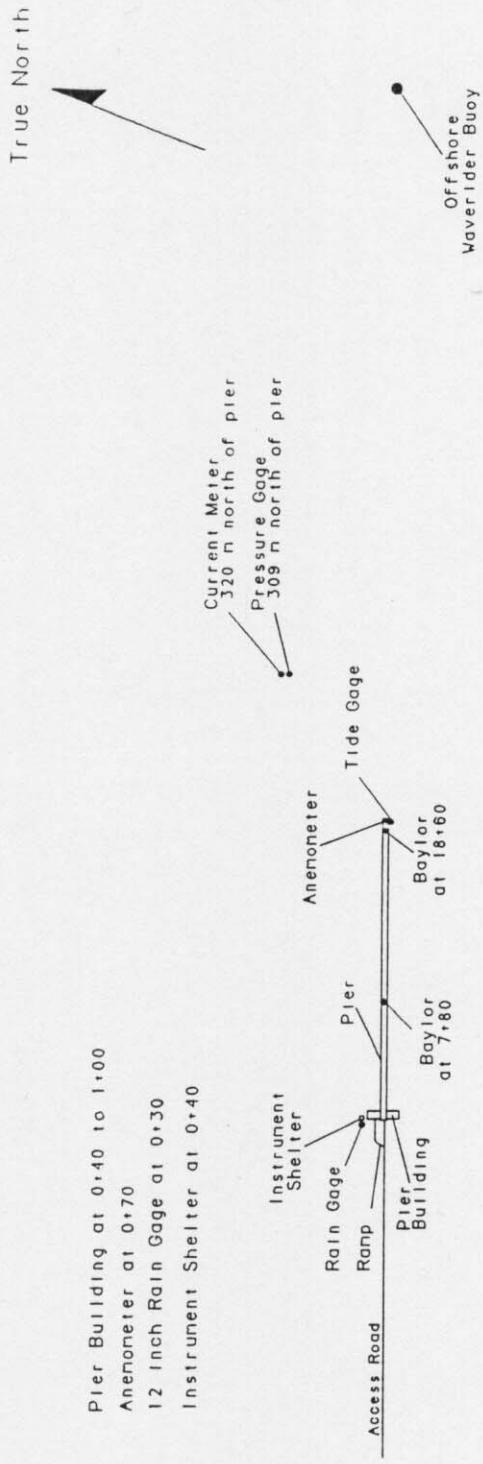


Figure 2. Instrument locations at FRF (all elevations from NGVD, all distances from FRF baseline).

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured at the end of the pier at an elevation of 19 m (Figure 2) using a Weather Measure Skyvane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Temperature and atmospheric pressure means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $mm \times .03937 = in.$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $mb \times 0.02953 = in. Hg$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

Table 2: Meteorological Data

Jan 1990

Day	Hour	** Wind	** Wind	Temperature	Atm	Precipitation ***
		Speed m/sec	Direction deg TN	deg C	mb	mm
1	100	9	201	13.0	1003.3	0
	700	11	293	8.0	1004.7	20
	1300	3	294	5.2	1012.5	0
	1900	7	295	3.9	1020.9	0
2	100	5	296	0.9	1026.0	0
	700	4	297	-0.3	1029.1	0
	1300	3	170	5.5	1028.7	0
	1900	5	190	2.0	1028.0	0
3	100	3	192	0.7	1027.7	0
	700	4	221	1.2	1027.7	0
	1300	4	196	9.7	1025.7	0
	1900	7	196	7.3	1024.7	0
4	100	3	216	7.4	1024.0	0
	700	1	205	5.8	1022.3	0
	1300	7	202	14.8	1018.6	0
	1900	9	198	12.7	1014.8	0
5	100	5	218	11.4	1014.8	0
	700	6	245	8.6	1016.9	0
	1300	6	358	7.7	1018.9	0
	1900	6	34	6.7	1018.6	0
6	100	6	64	6.9	1015.9	0
	700	5	15	7.1	1014.2	10
	1300	4	254	8.0	1013.5	0
	1900	4	359	4.6	1018.6	0
7	100	2	8	4.2	1020.3	0
	700	2	8	4.5	1020.6	3
	1300	4	48	5.4	1017.2	0
	1900	5	60	6.0	1015.5	0
8	100	5	7	5.0	1013.8	0
	700	8	15	6.3	1009.8	34
	1300	8	325	6.7	1000.6	0
	1900	10	280	4.9	1007.4	0
9	100	5	254	4.1	1014.2	0
	700	3	226	3.0	1016.9	7
	1300	5	186	8.5	1015.5	0
	1900	6	171	7.8	1011.4	0
10	100	9	212	7.3	1008.4	0
	700	9	240	6.8	1007.4	0
	1300	9	249	8.8	1008.7	0
	1900	7	283	8.3	1010.8	0
11	100	6	283	5.2	1013.5	0
	700	6	216	3.6	1013.5	0
	1300	12	181	11.6	1005.0	0
	1900	11	208	10.6	999.9	0
12	100	8	222	9.4	997.6	0
	700	7	264	8.2	1001.6	0
	1300	8	268	9.5	1001.3	0
	1900	7	281	6.4	1005.4	0
13	100	9	282	2.5	1009.4	0
	700	10	291	-0.2	1016.2	0
	1300	8	294	4.3	1019.6	0
	1900	5	279	3.1	1024.0	0
14	100	5	264	2.6	1025.7	0
	700	4	270	0.5	1028.0	0
	1300	2	110	6.0	1027.7	0
	1900	4	130	3.5	1027.7	0
15	100	3	209	3.6	1026.7	0
	700	4	207	5.5	1026.0	0
	1300	5	227	12.2	1023.3	0
	1900	3	211	8.3	1023.6	0
16	100	5	214	7.2	1024.0	0
	700	5	246	5.4	1025.3	0
	1300	*		12.1	1025.7	0
	1900	*		7.0	1026.0	0

* electronic problems

(Continued)

Table 2: Meteorological Data

Jan 1990

Day	Hour	** Wind	** Wind	Temperature	Atm	Precipitation ***
		Speed m/sec	Direction deg TN	deg C	mb	mm
17	100	*	*	6.4	1025.7	0
	700	*		5.8	1026.0	0
	1300	4	178	15.6	1023.6	0
	1900	7	192	13.4	1022.6	0
	100	6	206	10.6	1021.3	0
18	700	7	208	11.7	1019.9	0
	1300	7	240	16.3	1017.5	0
	1900	8	201	15.2	1017.2	0
	100	6	245	10.8	1018.2	0
19	700	9	3	6.8	1023.6	0
	1300	9	24	6.5	1025.7	0
	1900	7	32	5.8	1026.3	0
	100	7	36	6.3	1023.0	0
20	700	5	20	6.2	1022.3	0
	1300	4	345	7.6	1017.9	0
	1900	5	195	9.0	1014.8	0
	100	8	206	13.4	1011.8	0
21	700	3	235	13.4	1009.1	6
	1300	8	220	16.2	1005.0	0
	1900	5	263	12.9	1006.7	0
	100	6	27	7.3	1008.7	0
22	700	3	359	5.7	1011.8	0
	1300	7	244	11.4	1010.8	0
	1900	4	219	9.4	1011.4	0
	100	6	250	8.9	1013.5	0
23	700	3	341	6.6	1017.9	0
	1300	2	76	9.9	1018.2	0
	1900	2	118	7.1	1017.5	0
	100	4	131	7.7	1014.8	0
24	700		Software Error			0
	1300	5	193	18.0	1014.8	0
	1900	5	157	11.0	1016.9	0
	100	6	148	9.3	1013.8	0
	700	9	190	16.6	1012.8	0
25	1300	10	189	18.4	1010.4	0
	1900	12	178	17.3	1008.4	0
	100	11	181	17.5	1005.7	0
	700	11	263	11.8	1004.7	21
26	1300	8	343	5.4	1010.4	0
	1900	7	281	6.3	1018.6	0
	100	7	293	5.0	1023.0	0
	700	2	314	1.9	1026.3	3
27	1300	5	130	8.5	1027.7	0
	1900	4	186	6.8	1025.7	0
	100	5	213	7.2	1024.3	0
	700	5	224	7.2	1024.7	0
28	1300	7	240	13.3	1022.3	0
	1900	4	194	10.2	1021.9	0
	100	4	159	7.4	1019.6	0
	700	2	115	7.7	1017.2	0
29	1300	8	116	10.9	1009.4	0
	1900	10	181	16.9	1002.6	0
	100	11	275	13.2	1004.3	0
	700	6	280	7.9	1013.1	8
30	1300	2	23	10.7	1016.5	0
	1900	5	118	7.5	1017.2	0
	100	5	66	7.9	1015.9	0
	700	5	347	7.6	1018.6	6
31	1300	6	343	9.9	1022.3	0
	1900	5	11	7.6	1024.3	0
		Resultant 3	Mean 238	Mean 8.1	Total 1016.9	118

* electronic problems

(Sheet 2 of 2)

** Anemometer at end of pier used (gage No. 932)

*** Precipitation data was read daily from backup gage

PART III: WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hr (more frequently during storms) beginning at 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for four contiguous 34-min records.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

Table 3: Wave Data

Jan 1990

Day	Hour	645		625		111		630	
		Baylor at 7+80	Hmo,m T,sec	Baylor at 18+60	Hmo,m T,sec	Pressure Gage	Hmo,m T,sec	Offshr Wvrdr	Hmo,m T,sec
1	0100	0.71	8.53	0.75	9.14	0.82	9.48	1.18	8.83
	0700	0.55	9.48	0.65	9.14	0.78	8.53	1.06	9.48
	1300	1.03	5.45	0.95	5.12	1.02	5.22	1.24	5.22
	1900	0.75	5.22	0.78	6.24	0.83	5.02	1.03	5.12
2	0100	0.64	5.12	0.62	10.67	0.69	10.24	0.87	9.48
	0700	0.61	5.02	0.64	9.14	0.67	9.14	0.81	5.69
	1300	0.49	4.92	0.57	9.85	0.59	10.24	0.72	5.22
	1900	0.34	10.24	0.48	9.14	0.53	10.24	0.57	10.67
3	0100	0.27	10.67	0.38	9.48	0.41	9.85	0.47	10.24
	0700	0.25	10.24	0.34	9.85	0.37	9.48	0.43	10.24
	1300	0.25	10.24	0.31	10.24	0.35	10.24	0.41	9.85
	1900	0.28	10.24	0.34	9.85	0.38	9.85	0.44	9.48
4	0100	0.22	9.85	0.32	9.85	0.37	9.48	0.39	9.85
	0700	0.25	9.48	0.31	9.85	0.37	9.85	0.46	9.85
	1300	0.26	9.85	0.34	10.24	0.39	9.48	0.47	9.85
	1900	0.51	6.56	0.50	10.24	0.59	9.85	0.93	5.82
5	0100	0.40	9.85	0.50	9.85	0.59	9.48	0.89	9.48
	0700	0.42	9.48	0.48	9.48	0.52	9.85	0.74	5.95
	1300	0.35	8.83	0.40	8.53	0.51	9.85	0.69	6.40
	1900	0.42	9.85	0.46	9.48	0.43	9.85	0.55	9.85
6	0100	0.52	4.49	0.59	9.48	0.65	9.48	0.74	9.48
	0700	0.50	4.74	0.61	9.48	0.62	9.48	0.78	9.14
	1300	0.51	5.82	0.63	4.83	0.63	5.12	0.80	5.12
	1900	0.43	4.83	0.50	16.00	0.51	9.48	0.61	8.83
7	0100	0.31	8.83	0.42	8.53	0.48	8.53	0.56	9.14
	0700	0.37	16.00	0.42	9.85	0.50	9.48	0.54	9.48
	1300	0.50	4.41	0.51	9.85	0.59	9.14	0.68	9.14
	1900	0.44	4.41	0.50	8.83	0.57	8.83	0.65	7.11
8	0100	0.43	4.41	0.54	9.14	0.57	9.14	0.69	6.92
	0700	0.50	4.41	0.59	4.27	0.59	9.14	0.74	8.26
	1300	0.83	6.09	0.97	6.24	1.06	5.82	1.34	6.09
	1900	0.79	6.74	0.86	6.24	0.96	6.74	1.15	6.74
9	0100	0.70	6.56	0.66	6.56	0.65	6.56	0.87	5.12
	0700	0.60	6.40	0.68	6.92	0.69	7.11	0.80	6.40
	1300	0.69	7.11	0.82	7.76	0.82	8.00	0.89	7.31
	1900	0.59	9.14	0.75	9.48	0.77	9.14	1.00	8.26
10	0100	0.36	8.83	0.59	8.83	0.58	8.83	0.81	9.48
	0700	0.37	8.83	0.44	8.83	0.50	8.53	0.79	8.83
	1300	0.30	9.14	0.33	8.53	0.39	9.14	0.69	5.33
	1900	0.32	4.27	0.43	8.83	0.40	3.56	0.73	7.53
11	0100	0.24	4.83	0.26	8.53	0.28	9.48	0.40	4.74
	0700	0.21	8.83	0.25	12.19	0.29	8.83	0.33	12.80
	1300	0.45	2.81	0.46	11.13	0.40	11.64	0.65	2.84
	1900	0.32	11.13	0.41	10.67	0.36	11.64	0.80	3.94
12	0100	0.31	5.12	0.31	12.19	0.35	11.13	0.48	7.31
	0700	0.30	7.31	0.35	7.76	0.39	7.53	0.55	7.76
	1300	0.26	11.13	0.27	12.19	0.28	12.19	0.55	2.37
	1900	0.27	10.24	0.31	11.13	0.32	10.67	0.49	11.13
13	0100	0.54	4.66	0.56	4.20	0.65	4.20	0.87	4.13
	0700	0.77	5.57	0.75	5.33	0.77	5.33	1.22	5.33
	1300	0.98	5.69	0.78	5.82	0.86	5.69	1.27	5.45
	1900	0.52	5.82	0.49	5.69	0.56	5.45	0.91	4.92
14	0100	0.44	5.33	0.39	5.33	0.42	5.45	0.52	6.09
	0700	0.38	6.74	0.44	6.74	0.51	6.74	0.58	6.74
	1300	0.47	6.24	0.46	6.09	0.53	6.40	0.58	7.11
	1900	0.48	5.22	0.52	6.74	0.56	6.09	0.65	6.24
15	0100	0.29	5.12	0.35	5.95	0.37	5.95	0.43	6.09
	0700	0.19	9.48	0.25	8.53	0.27	8.26	0.33	8.00
	1300	0.16	12.19	0.21	11.64	0.24	7.31	0.26	10.24
	1900	0.15	9.48	0.20	9.48	0.24	9.85	0.27	9.14
16	0100	0.20	11.13	0.22	9.85	0.26	10.24	0.31	9.14
	0700	0.20	9.85	0.23	9.48	0.25	10.24	0.34	9.48
	1300	0.26	4.66	0.28	9.14	0.30	9.85	0.41	8.83
	1900	0.21	9.85	0.28	9.48	0.34	10.24	0.38	9.48

* Electronic problems

(Continued)

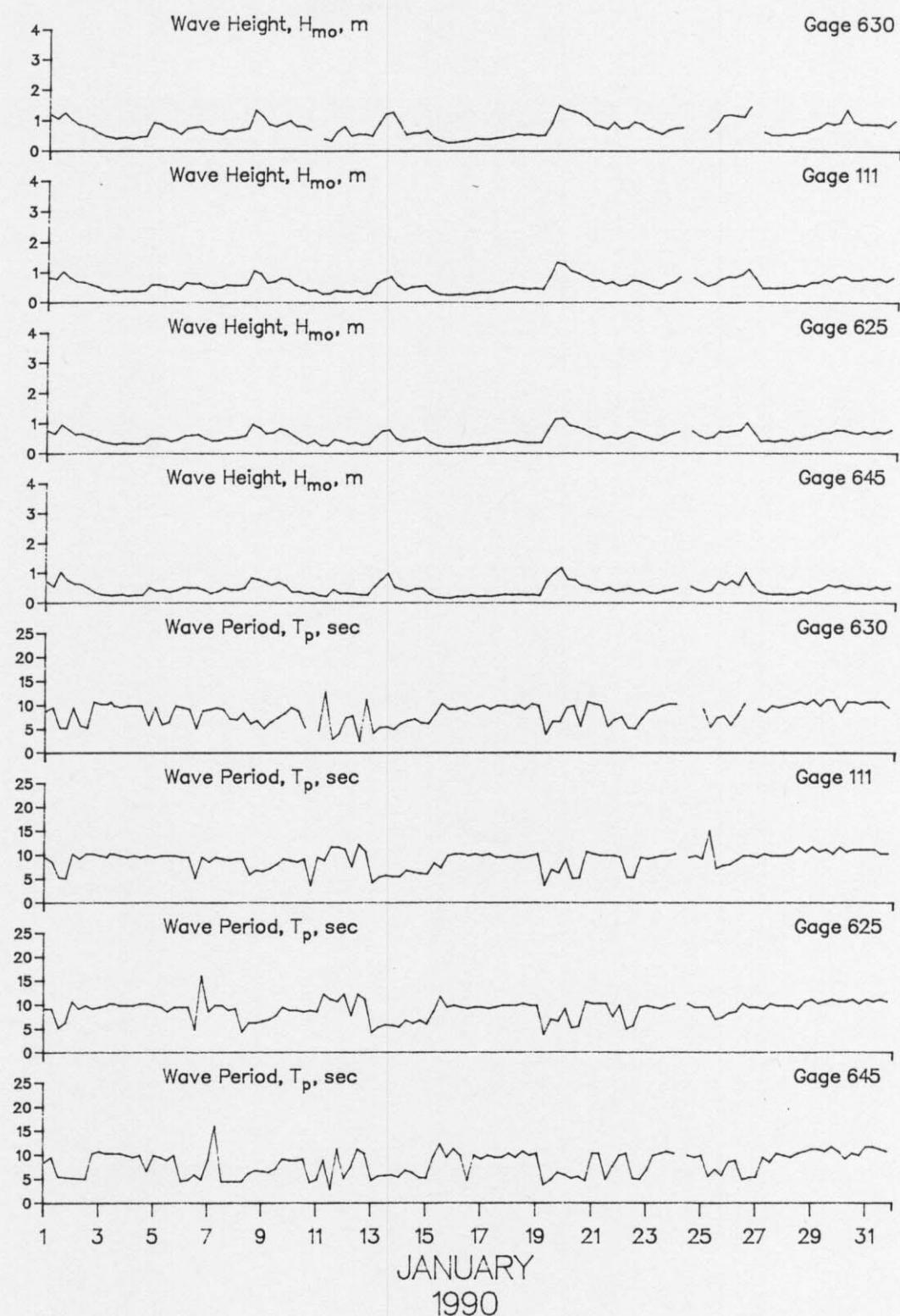
Table 3: Wave Data

Jan 1990

Day	Hour	645		625		111		630	
		Baylor	at 7+80	Baylor	at 18+60	Pressure Gage		Offshsr	Wvrdr
Hmo,m	T.sec	Hmo,m	T.sec	Hmo,m	T.sec	Hmo,m	T.sec	Hmo,m	T.sec
17	0100	0.22	9.14	0.28	9.48	0.33	9.85	0.38	9.85
	0700	0.21	9.85	0.32	9.14	0.36	10.24	0.42	9.14
	1300	0.25	9.48	0.35	9.48	0.43	9.48	0.45	9.85
	1900	0.29	9.48	0.39	9.85	0.48	9.48	0.49	9.85
18	0100	0.27	10.24	0.43	9.85	0.52	9.85	0.55	9.48
	0700	0.28	9.48	0.38	9.85	0.46	9.48	0.53	9.85
	1300	0.26	10.67	0.36	10.24	0.45	9.48	0.54	9.14
	1900	0.28	9.85	0.35	9.85	0.47	9.85	0.50	10.24
19	0100	0.24	10.24	0.35	9.85	0.43	10.24	0.51	9.85
	0700	0.73	3.71	0.77	3.77	0.84	3.61	0.89	3.88
	1300	0.99	4.74	1.14	6.92	1.33	6.92	1.49	6.56
	1900	1.17	6.24	1.17	6.56	1.26	6.24	1.36	6.56
20	0100	0.78	5.82	0.93	9.14	1.04	9.14	1.30	9.48
	0700	0.75	5.12	0.88	5.12	0.97	5.02	1.22	9.85
	1300	0.58	5.45	0.80	5.45	0.86	5.12	1.07	5.57
	1900	0.54	4.57	0.67	10.67	0.73	10.67	0.85	10.67
21	0100	0.43	10.24	0.61	10.24	0.71	10.24	0.79	10.24
	0700	0.43	10.24	0.49	10.24	0.62	9.85	0.71	9.85
	1300	0.50	4.83	0.54	10.24	0.68	9.85	0.94	5.57
	1900	0.39	7.53	0.47	7.53	0.55	9.85	0.74	6.92
22	0100	0.44	9.85	0.56	9.85	0.59	9.48	0.76	7.53
	0700	0.48	10.24	0.70	4.92	0.74	5.22	0.95	5.12
	1300	0.39	5.02	0.64	5.57	0.70	5.22	0.89	5.02
	1900	0.44	4.83	0.55	9.48	0.61	9.48	0.71	7.11
23	0100	0.33	6.74	0.46	9.85	0.52	9.14	0.63	8.83
	0700	0.31	9.85	0.43	9.48	0.46	9.48	0.55	9.14
	1300	0.39	10.24	0.55	9.14	0.60	9.85	0.68	9.85
	1900	0.43	10.67	0.65	9.85	0.68	9.85	0.74	10.24
24	0100	0.49	10.24	0.71	10.24	0.84	10.24	0.76	10.24
	0700				Software Error				
	1300	0.55	9.85	0.74	10.24	0.82	9.48	0.86	9.85
	1900	0.43	9.48	0.58	9.48	0.67	9.85	0.75	9.85
25	0100	0.37	9.85	0.49	9.48	0.55	9.14	0.64	9.14
	0700	0.43	5.45	0.54	9.48	0.61	15.06	0.83	5.33
	1300	0.72	6.92	0.72	6.92	0.77	7.11	1.16	7.31
	1900	0.61	5.69	0.71	7.31	0.85	7.76	1.19	7.76
26	0100	0.75	8.53	0.75	8.26	0.84	8.00	1.15	5.82
	0700	0.60	8.83	0.77	8.53	0.92	8.83	1.11	7.76
	1300	1.01	4.83	1.01	10.24	1.10	9.85	1.44	10.24
	1900	0.62	5.22	0.70	9.48	0.82	9.85	0.98	9.14
27	0100	0.37	5.33	0.39	9.48	0.46	9.48	0.62	9.14
	0700	0.31	9.48	0.41	9.14	0.47	10.24	0.52	8.53
	1300	0.28	8.53	0.38	10.24	0.47	9.85	0.51	9.85
	1900	0.30	10.24	0.44	9.85	0.49	9.85	0.55	9.48
28	0100	0.28	9.85	0.40	9.85	0.50	9.85	0.53	9.85
	0700	0.29	9.48	0.50	9.85	0.57	10.24	0.60	10.24
	1300	0.36	10.24	0.46	9.14	0.55	11.64	0.61	10.67
	1900	0.33	10.67	0.53	10.67	0.66	10.67	0.71	10.24
29	0100	0.41	11.13	0.60	11.13	0.67	11.64	0.79	11.13
	0700	0.47	11.13	0.68	10.24	0.76	10.67	0.94	9.85
	1300	0.61	10.67	0.69	10.67	0.69	11.13	0.88	11.13
	1900	0.55	11.64	0.77	11.13	0.85	10.24	0.94	11.13
30	0100	0.59	10.67	0.77	10.67	0.86	11.64	1.35	8.53
	0700	0.51	9.14	0.70	10.67	0.74	10.67	0.97	10.67
	1300	0.48	10.24	0.65	11.13	0.74	11.13	0.87	10.67
	1900	0.51	9.85	0.73	10.24	0.80	11.13	0.88	10.24
31	0100	0.46	11.64	0.65	11.13	0.76	11.13	0.86	10.67
	0700	0.54	11.64	0.71	10.67	0.80	11.13	0.88	10.67
	1300	0.46	11.13	0.67	11.13	0.70	10.24	0.80	10.67
	1900	0.52	10.67	0.77	10.67	0.82	10.24	0.99	9.48
Mean		0.45	8.09	0.54	9.01	0.60	9.00	0.75	8.29
Std dev		0.20	2.53	0.20	1.97	0.22	1.98	0.27	2.11

* Electronic problems

(Sheet 2 of 2)



PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the data.

Table 4: Current Data
Jan 1990

Day	Pier Measurements				Beach Measurements				Current Meter	
	Alongshore Cross-shore Resultant	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	12m offshore (surface)	Location	Speed	Dir	Speed	Dir
1 0100-Along Cross Result									8	N
1 0700-Along Cross Result	22 9 23	S on 182		140	28 11 30	S on 182	18	S	7 10 13	on 299 292
1 1300-Along Cross Result									14 5 15	S off 140
1 1900-Along Cross Result									9 2 9	S off 147
2 0100-Along Cross Result									9 5 10	S off 131
2 0700-Along Cross Result	6 6 8	N off 25		128	36 18 40	S off 133	0		6 5 8	N on 300
2 1300-Along Cross Result									8 1 8	N on 333
2 1900-Along Cross Result									14 8 16	N on 310
3 0100-Along Cross Result									11 5 12	N on 316
3 0700-Along Cross Result	27 4 27	N off 349		140	25 15 30	N off 11	18	N	13 6 14	N on 315
3 1300-Along Cross Result									8 5 9	N on 308
3 1900-Along Cross Result									10 7 12	N on 305
4 0100-Along Cross Result									2 3 4	N on 284
4 0700-Along Cross Result	29 0 29	N 140			28 17 32	N off 11	37	N	4 2 4	N on 313
4 1300-Along Cross Result									3 5 6	N on 281
4 1900-Along Cross Result									5 6 8	N on 290
5 0100-Along Cross Result									2 5 5	N on 272
5 0700-Along Cross Result	3 8 8	N off 48		140	55 6 56	N off 346	33	N	4 1 4	N on 326
5 1300-Along Cross Result									2 2 3	N off 25
5 1900-Along Cross Result									6 8 10	S off 107

KEY = All speeds in cm/sec

N = Northward, Shore parallel

S = Southward, Shore parallel

on = onshore off = offshore

Table 4: Current Data (Continued)
Jan 1990

Alongshore Cross-shore Resultant Time Day	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter	
	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519
6 0100-Along Cross Result										13 5 14
6 0700-Along Cross Result	32 3	S on	140	10 29	N off	11	N	12 3 12	S off 146	139
6 1300-Along Cross Result	32	166		31	52					5 1 5
6 1900-Along Cross Result										28 16 32
7 0100-Along Cross Result										12 0
7 0700-Along Cross Result	47 0	S on	140	0 33	off	2	N	5 7 9	S off 106	160
7 1300-Along Cross Result	47	160		33 70						17 11 20
7 1900-Along Cross Result										11 3 11
8 0100-Along Cross Result										2 0 2
8 0700-Along Cross Result	28 11	S on	128	18 5	N on	36	N	4 2 4	S off 133	160
8 1300-Along Cross Result	30	182		19 323						38 12 40
8 1900-Along Cross Result										19 9 21
9 0100-Along Cross Result										31 12 33
9 0700-Along Cross Result	21 0	S on	140	41 16	S on	18	S	6 1 6	S on 169	139
9 1300-Along Cross Result	21	160		44 182						19 11 22
9 1900-Along Cross Result										20 3 20
10 0100-Along Cross Result										3 7 8
10 0700-Along Cross Result	12 24	N off	128	20 4	N off	1	N	6 9 11	N on 284	273
10 1300-Along Cross Result	27	43		20 351						3 7 8
10 1900-Along Cross Result										3 0 3
										160

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Jan 1990

Day	Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter	
		Dye at (579 m) (surface)	Dye at Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir
11 0100-Along Cross Result									12	S
									4	off
									13	142
11 0700-Along Cross Result	17 3 off 349	N		10 1 off 346	N		3 N		1	N
							South		8	off
									8	63
11 1300-Along Cross Result									15	N
									7	on
									17	315
11 1900-Along Cross Result									14	N
									8	on
									16	310
12 0100-Along Cross Result									3	N
									9	on
									9	268
12 0700-Along Cross Result	10 4 off 11 138	S		0 4 off 70			4 S		4	N
							South		6	on
									7	284
12 1300-Along Cross Result									7	S
									0	
									7	160
12 1900-Along Cross Result									11	S
									5	off
									12	136
13 0100-Along Cross Result									14	S
									5	off
									15	140
13 0700-Along Cross Result	20 2 off 20 154	S		68 20 on 177	S		41 S		8	S
							North		2	off
									8	146
13 1300-Along Cross Result									16	S
									7	off
									17	136
13 1900-Along Cross Result									19	S
									9	off
									21	135
14 0100-Along Cross Result									19	S
									4	off
									19	148
14 0700-Along Cross Result	28 11 on 30 182	S		38 6 on 169	S		8 S		3	S
							North		2	off
									4	126
14 1300-Along Cross Result									7	S
									6	off
									9	119
14 1900-Along Cross Result									6	N
									3	on
									7	313
15 0100-Along Cross Result									0	
									0	
									0	
15 0700-Along Cross Result	20 2 off 20 346	N		5 2 off 2	N		7 S		9	N
							South		5	on
									10	311
15 1300-Along Cross Result									4	N
									3	on
									5	303
15 1900-Along Cross Result									4	N
									5	on
									6	289

KEY = All speeds in cm/sec

N = Northward, Shore parallel

S = Southward, Shore parallel

on = onshore off = offshore

Table 4: Current Data (Continued)
Jan 1990

Day	Time	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter		
		Alongshore Cross-Shore Resultant	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir
16	0100-Along Cross Result									10	S
										6	off
										12	129
16	0700-Along Cross Result	6	N			8	N		3	3	S
		12	off	118		1	off	South		1	on
		13	45			8	346			3	178
16	1300-Along Cross Result									3	S
										4	off
										5	107
16	1900-Along Cross Result									1	N
										2	on
										2	277
17	0100-Along Cross Result									4	S
										1	off
										4	146
17	0700-Along Cross Result	20	N			34	N		36	3	S
		0		128		2	off	South		1	off
		20	340			34	343			3	142
17	1300-Along Cross Result									6	S
										1	on
										6	169
17	1900-Along Cross Result									5	S
										2	on
										5	182
18	0100-Along Cross Result									1	S
										2	on
										2	223
18	0700-Along Cross Result	21	N			32	N		30	5	N
		8	off	140		5	off	South		7	on
		23	2			32	349			9	286
18	1300-Along Cross Result									5	N
										7	on
										9	286
18	1900-Along Cross Result									8	N
										5	on
										9	308
19	0100-Along Cross Result									4	N
										5	on
										6	289
19	0700-Along Cross Result	24	S			68	S		46	10	S
		10	off	140		10	on	North		4	off
		26	138			68	169			11	138
19	1300-Along Cross Result									14	S
										7	off
										16	133
19	1900-Along Cross Result									11	S
										11	off
										16	115
20	0100-Along Cross Result									36	S
										8	off
										37	147
20	0700-Along Cross Result	47	S			28	S		34	19	S
		0		140		11	on	North		5	off
		47	160			30	182			20	145
20	1300-Along Cross Result									18	S
										5	off
										19	144
20	1900-Along Cross Result									15	S
										3	off
										15	149

KEY = All speeds in cm/sec

N = Northward, Shore parallel

S = Southward, Shore parallel

on = onshore off = offshore

Table 4: Current Data (Continued)
Jan 1990

Day	Time	Pier Measurements				Beach Measurements			Current Meter	
		Alongshore Cross-shore Resultant Dye at (579 m) (surface)	Cross-shore Resultant Dye at (579 m) (surface)	Distance from Baseline (m)	Speed Dir	Dye at Mid-Surf Zone (surface)	Location	Speed Dir	Dye 12m offshore (surface)	Depth -5.6m (NGVD)
21	0100-Along Cross Result								3	0.9 km Offshore
	Speed	Dir							3	Depth -5.6m
	28	N							4	(NGVD)
	8	off							7	ID #519
	29	357		140		61	N		1	Speed
						18	off		7	Dir
						64	357		7	205
									3	
									1	
									6	
									7	
									1	
									0	
									1	
									1	160
									8	S
									11	off
									14	106
									0	
									14	
									1	
									7	
									4	
									8	
									1	190
									11	S
									4	off
									12	140
									10	S
									8	off
									13	121
									12	S
									10	off
									16	120
									9	S
									5	off
									10	131
									16	S
									5	off
									17	143
									0	
									4	on
									4	250
									9	
									1	
									9	334
									0	
									1	
									1	off
									1	70
									4	N
									4	on
									6	295
									5	N
									8	on
									9	282
									10	N
									6	on
									12	309
									8	N
									7	on
									11	299

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Jan 1990

Alongshore Cross-Shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter	
	Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519
Time	Speed	Dir							
Day									
26 0100-Along Cross Result									22 N
									9 on
									24 318
26 0700-Along Cross Result	30 8	S on	128	61 0	N	10 N	15	N	
	31	174		61	340	North	10	on	
							18	306	
26 1300-Along Cross Result							12	S	
							4	off	
							13	142	
26 1900-Along Cross Result							18	S	
							4	off	
							18	147	
27 0100-Along Cross Result							12	S	
							3	off	
							12	146	
27 0700-Along Cross Result	3 0	N	140	41 24	N on	24 N	6	S	
	3	340		47	309	South	1	off	
							6	151	
27 1300-Along Cross Result							2	S	
							4	off	
							4	97	
27 1900-Along Cross Result							4	N	
							2	on	
							4	313	
28 0100-Along Cross Result							11	S	
							3	off	
							11	145	
28 0700-Along Cross Result	5 12	N off	140	76 0	N	15 N	10	N	
	13	48		76	340	South	7	on	
							12	305	
28 1300-Along Cross Result							8	N	
							6	on	
							10	303	
28 1900-Along Cross Result							6	N	
							5	on	
							8	300	
29 0100-Along Cross Result							8	S	
							3	off	
							9	139	
29 0700-Along Cross Result	7 3	N on	128	76 19	N on	76 N	0	N	
	8	313		79	326	South	3	on	
							3	250	
29 1300-Along Cross Result							6	S	
							3	off	
							7	133	
29 1900-Along Cross Result							6	S	
							4	on	
							7	194	
30 0100-Along Cross Result							2	N	
							3	on	
							4	284	
30 0700-Along Cross Result	15 4	S off	128	47 0	N	30 N	1	S	
	16	146		47	340	South	3	on	
							3	232	
30 1300-Along Cross Result							1	S	
							2	off	
							2	97	
30 1900-Along Cross Result							4	N	
							4	on	
							6	295	

KEY = All speeds in cm/sec

N = Northward, Shore parallel

S = Southward, Shore parallel

on = onshore off = offshore

Table 4: Current Data (Concluded)
Jan 1990

Alongshore Cross-shore Resultant Time Day	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter		
	Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir
31 0100-Along Cross Result										2	N
31 0700-Along Cross Result	6 0 6	S 140 160		20 5 21	N off 354			55	N	11 5 12	N on 313
31 1300-Along Cross Result										1 0 1	N 340
31 1900-Along Cross Result										5 1 5	S off 149

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves) are taken daily at the seaward end of the pier. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests at approximately the same location as the visual measurements. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are also taken daily at the seaward end of the pier. A jar along with a thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The jar is removed, the temperature read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the surface visibility.

Table 5: Supplemental Observations

Jan 1990

Day	Time	Wave Approach		Radar Wave Angle deg from True N	Width of Surf Zone,m	Water Characteristics at Pier End		
		Primary	Secondary			Temp.,C	Density g/cc	Secchi Vis.,m
1	0900	20			61	4.7	1.0256	0.3
2	0825	30			43	4.4	1.0260	0.3
3	0845	65			24	5.0	1.0254	0.3
4	0910	none visible			29	5.6	1.0260	0.6
5	0850	130			52	5.6	1.0263	0.6
6	0950	80			58	4.7	1.0224	1.2
7	0850	80	40		61	4.4	1.0214	1.5
8	0735	40			47	4.4	1.0206	2.4
9	0745	15			44	5.6	1.0226	
10	0800	135			20	5.6	1.0250	0.9
11	0815	105			4	5.0	1.0252	2.7
12	0915	110	355		12	6.1	1.0258	2.4
13	1230	40	10		80	5.6	1.0256	1.8
14	1115	0			49	4.4	1.0222	3.4
15	1130	115			5	5.6	1.0240	2.7
16	0830	125			17	5.6	1.0244	2.7
17	0900	95			12	6.7	1.0241	3.0
18	0815	130			47	6.1	1.0251	1.8
19	0830	10			45	6.7	1.0254	1.5
20	0920	90			84	6.7	1.0200	1.8
21	0915	140			45	7.2	1.0228	1.8
22	0900	50	10		73	6.7	1.0234	5.2
23	0830	80	120		46	7.2	1.0229	4.9
24	0705	85	115		42	7.8	1.0224	3.4
25	0720	135			29	7.8	1.0244	2.1
26	0900	100	10		34	7.8	1.0253	1.5
27	0945	20	110		27	7.2	1.0256	1.2
28	1008	100			43	7.2	1.0244	1.8
29	0815	100			37	7.2	1.0258	1.2
30	0830	90	10		43	7.8	1.0256	1.5
31	0840	85	45		47	8.3	1.0256	1.8

PART VI: WATER LEVELS

Since 1978, the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service (NOS) has operated a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect instantaneous water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 4 along with a list of mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level.

Table 6 contains the time at the center of each 12.42-hr tidal cycle and the range, high, low, and mean water levels during each tidal cycle.

FRF Tide Heights

Jan 1990

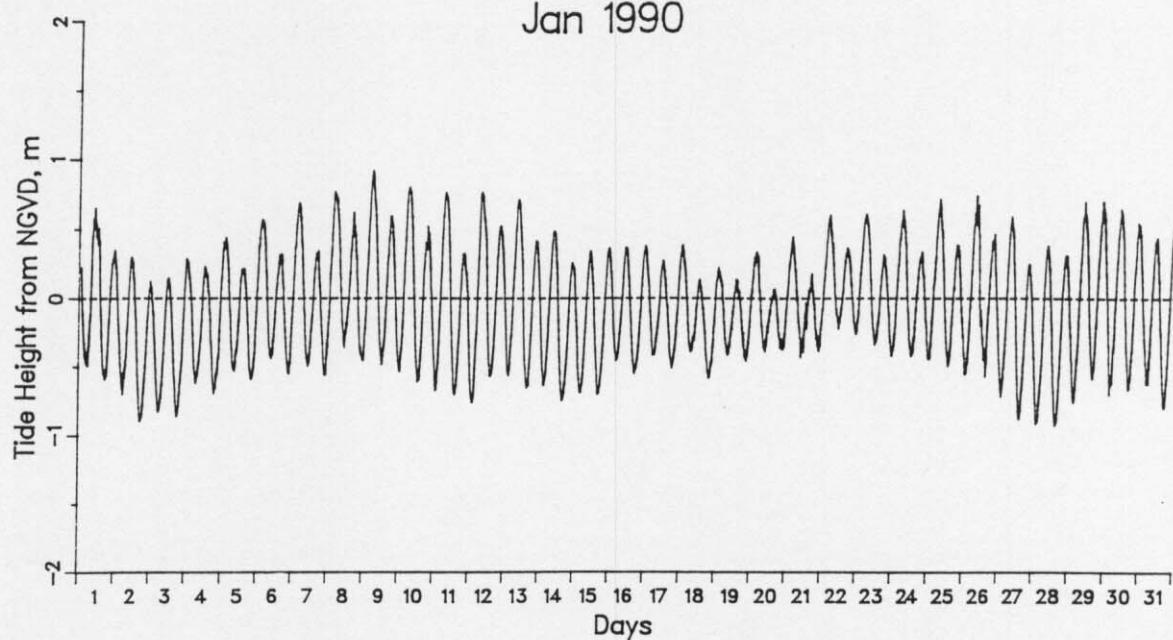


Figure 4. Water Level Time History

Monthly Water Levels, m NGVD

Extreme Low = -0.93 on day 28 at 1418 EST
Extreme High = 0.92 on day 9 at 518 EST
Monthly Mean = -0.06
Mean Low = -0.58
Mean High = 0.49
Mean Range = 1.07

Table 6: Water Levels, m NGVD

		Jan 1990			
Mid-Cycle Day	Time	Low	High	Mean	Range
1	612	-0.49	0.66	0.06	1.15
1	1837	-0.59	0.41	-0.10	1.00
2	703	-0.70	0.30	-0.18	1.00
2	1928	-0.89	0.12	-0.39	1.01
3	753	-0.83	0.15	-0.34	0.98
3	2018	-0.86	0.29	-0.30	1.15
4	843	-0.62	0.23	-0.18	0.85
4	2109	-0.69	0.44	-0.14	1.13
5	934	-0.53	0.23	-0.12	0.75
5	2159	-0.59	0.57	-0.03	1.16
6	1024	-0.44	0.41	-0.02	0.84
6	2249	-0.55	0.69	0.04	1.24
7	1115	-0.50	0.53	-0.04	1.02
7	2340	-0.56	0.77	0.06	1.34
8	1205	-0.36	0.64	0.15	1.00
9	30	-0.46	0.92	0.15	1.38
9	1255	-0.49	0.71	0.11	1.19
10	121	-0.54	0.80	0.12	1.34
10	1346	-0.61	0.68	0.00	1.29
11	211	-0.67	0.77	0.05	1.44
11	1436	-0.70	0.65	-0.10	1.35
12	301	-0.76	0.77	-0.05	1.53
12	1527	-0.57	0.59	0.03	1.16
13	352	-0.56	0.72	0.07	1.28
13	1617	-0.66	0.52	-0.07	1.17
14	442	-0.63	0.49	-0.07	1.12
14	1707	-0.75	0.31	-0.22	1.06
15	532	-0.69	0.34	-0.18	1.03
15	1758	-0.70	0.37	-0.19	1.07
16	623	-0.46	0.37	-0.04	0.83
16	1848	-0.55	0.38	-0.11	0.93
17	713	-0.41	0.27	-0.06	0.69
17	1938	-0.51	0.38	-0.09	0.89
18	804	-0.39	0.26	-0.10	0.66
18	2029	-0.58	0.23	-0.21	0.81
19	854	-0.41	0.14	-0.13	0.55
19	2119	-0.46	0.34	-0.09	0.79
20	944	-0.39	0.30	-0.11	0.69
20	2210	-0.37	0.45	-0.03	0.82
21	1035	-0.43	0.29	-0.08	0.72
21	2300	-0.38	0.61	0.05	0.99
22	1125	-0.22	0.48	0.11	0.70
22	2350	-0.26	0.61	0.16	0.87
23	1216	-0.34	0.49	0.03	0.83
24	41	-0.42	0.64	0.06	1.06
24	1306	-0.42	0.49	0.00	0.92
25	131	-0.45	0.72	0.08	1.16
25	1356	-0.50	0.50	0.00	1.00
26	222	-0.55	0.75	0.02	1.30
26	1447	-0.57	0.58	0.01	1.15
27	312	-0.72	0.59	-0.08	1.31
27	1537	-0.88	0.26	-0.26	1.14
28	402	-0.92	0.38	-0.27	1.30
28	1628	-0.93	0.31	-0.28	1.24
29	453	-0.76	0.70	-0.07	1.47
29	1718	-0.59	0.71	0.06	1.30
30	543	-0.71	0.66	0.02	1.36
30	1808	-0.67	0.55	-0.05	1.22
31	634	-0.62	0.44	-0.07	1.07
31	1859	-0.80	0.57	-0.18	1.37

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in December and the two surveys in January on profile line 188, located 517 m south of the pier. The absence of any storms in January resulted in only small changes to the profile. These included the development of a berm (90 m) and a steepening of the beach face (100 - 115 m) with a small nearshore bar (120 - 220 m) developing then being removed. Offshore only minor changes are visible.

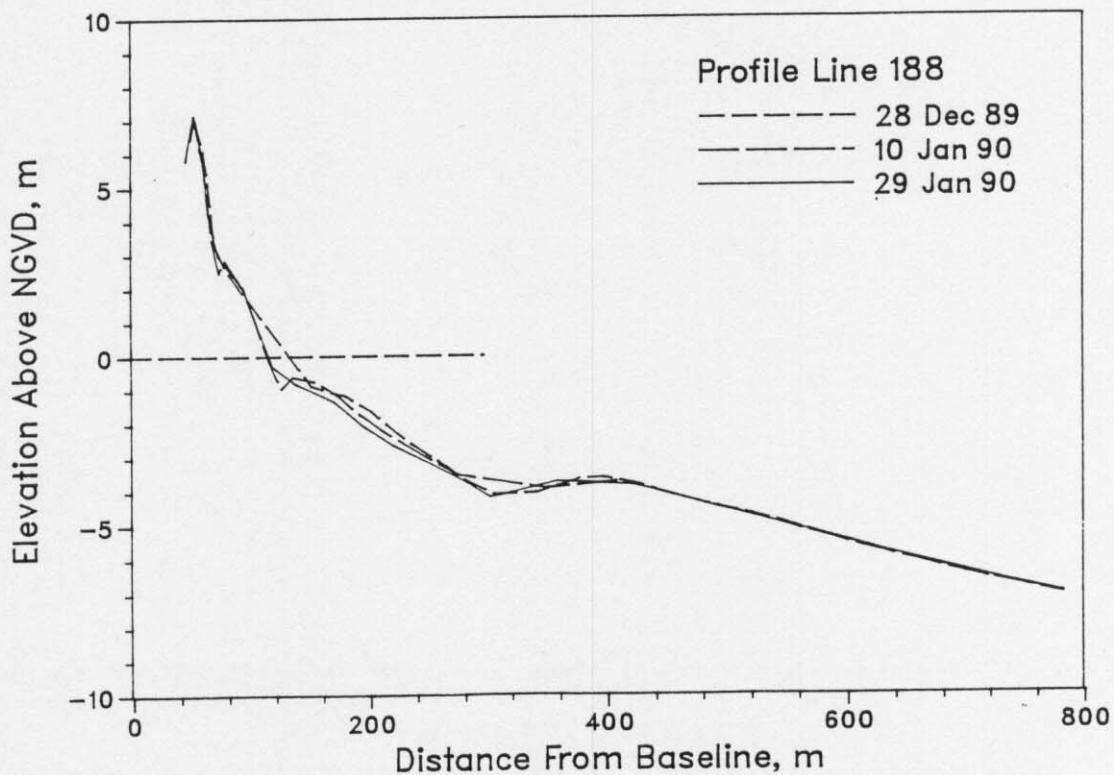


Figure 5. Monthly CRAB profiles on profile 188 - 517 m south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during January 1990.

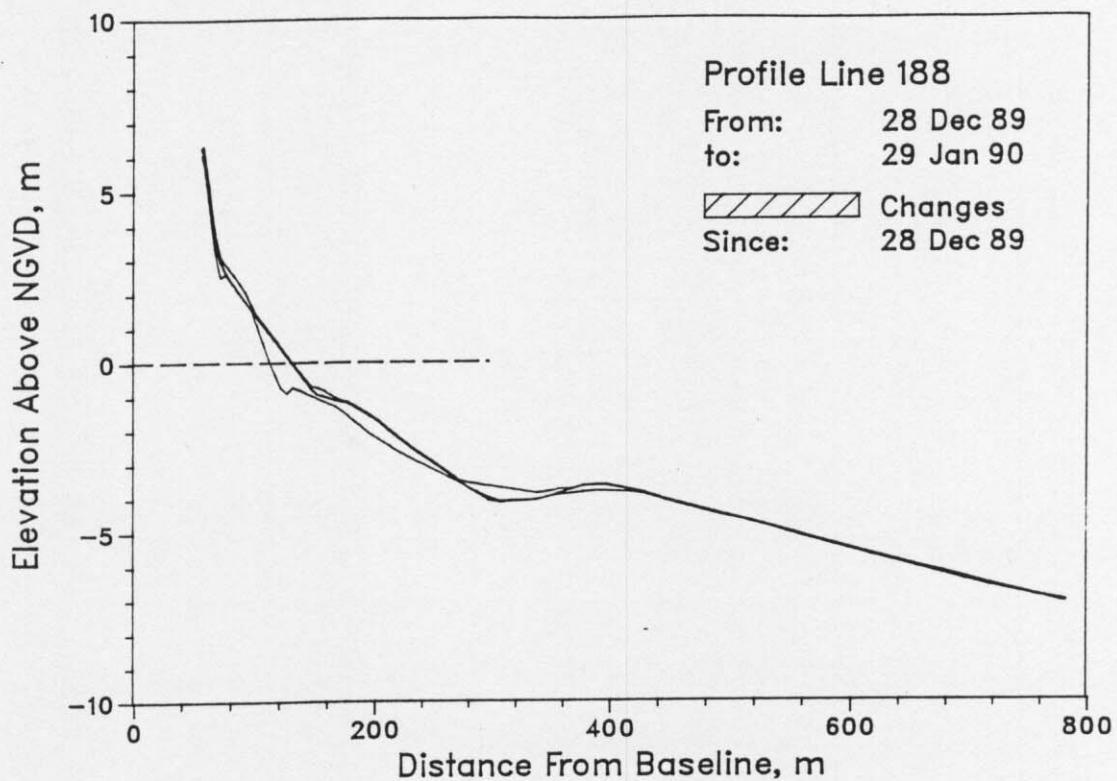


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey on 7 December. Wide contour lines on the change diagram represent eroded areas; thin lines indicate deposition.

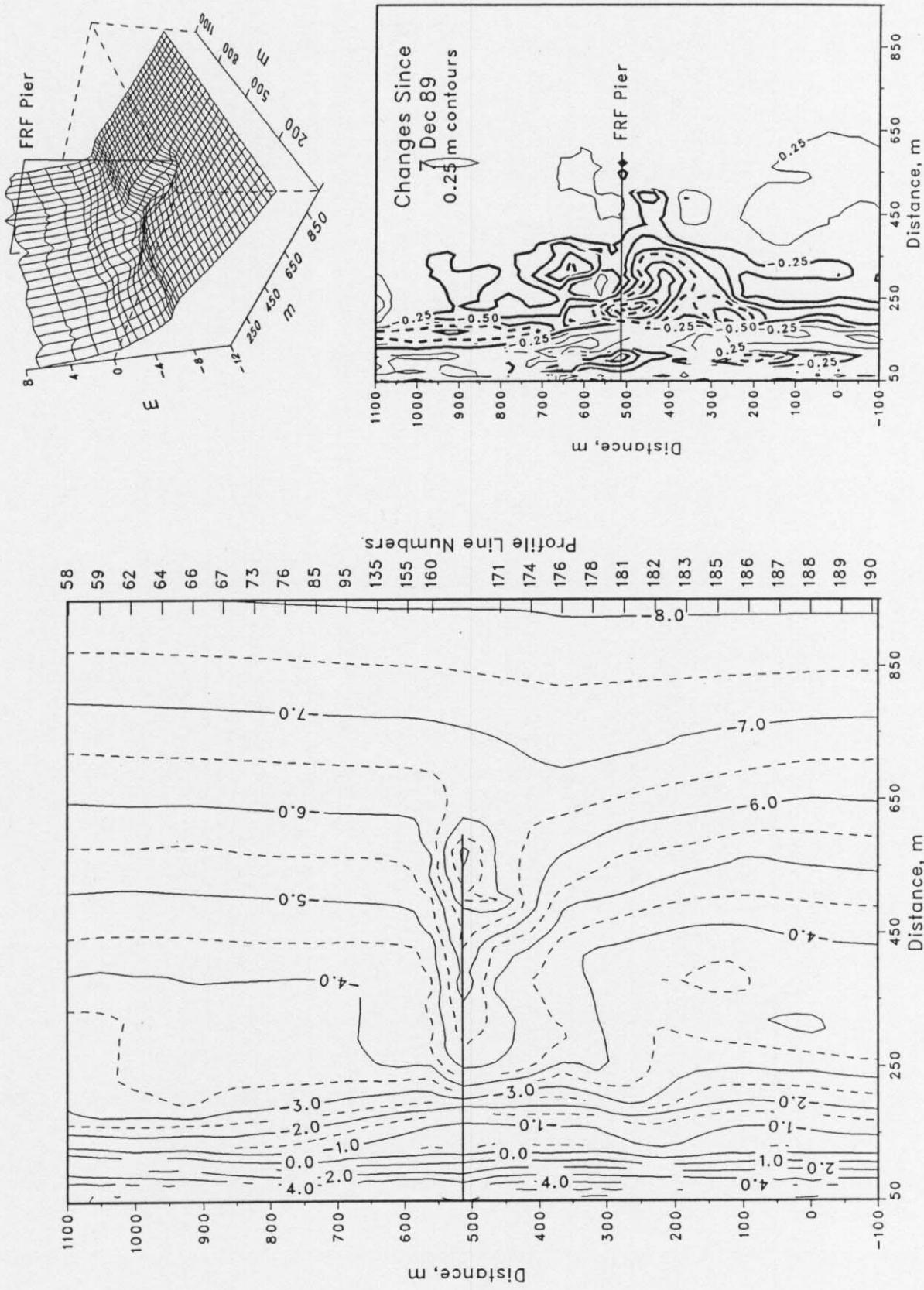


Figure 7. FRF bathymetry 29 Jan 90 depths relative to NGVD

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